occurred. Whether the injury to the arm was the source of the change is not apparent.

It will be seen, therefore, from the above account that both descriptions of the tube-feet arrangement are correct, but that the one usually given in text-books (Type I) is by far the more common; furthermore, that the one type may change to the other with no apparent structural reasons for the transformation.

The facts here presented furnish, I believe, a complete explanation of the difference in the laboratory accounts as given by different teachers.

ROBERT H. BOWEN

MARINE BIOLOGICAL LABORATORY,
WOODS HOLE, MASS.

THE MICRO-FILTER FOR MINUTE FLAGELLATES

IT is frequently desirable during the study of the minuter protozoa, and especially of the small flagellates, to concentrate the organisms. This the writer has been able to do in a very simple and satisfactory manner by means of the device shown in Fig. 1, which may be called the micro-filter; a name applied not only because of its office, but also because of the minute piece of filter-paper used.

The contrivance consists of a standard, either of wood or of metal, which supports a burette tube, a minute circle of filter-paper, and a vessel beneath. The water containing the protozoa to be concentrated is introduced into the burette from above, by means of a funnel, and the pinch cock (O) opened sufficiently to allow the liquid to drop into the small funnel or circle of filter-paper beneath (P). The filter is supported by means of stout copper wire. The flow of water from the burette can be nicely regulated by means of the pinch cock, which, to give the best results, should be of the screw variety. The water drops through a glass tube, drawn out into a fine point (T). It was found convenient to have several of these tips of different diameters.

Considerable experimentation is necessary before the exact balance between the flow of water from the burette and that from the base of the filter-paper funnel can be secured. When this balance is reached, the burette is filled and the water allowed

to filter into the vessel on the base of the stand. It is necessary, at approximately fifteen-minute intervals, to thrust into the burette, as far down as the shoulder, or point of taper (just above the rubber tube on which the pinch cock rides), a straight

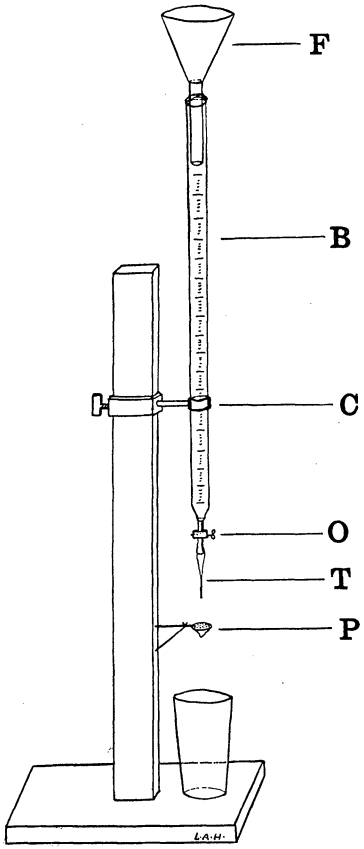

FIG. 1. The Micro-filter. Simple wooden stand for the micro-filter, supporting: funnel (*F*), burette (*B*), clamp for holding burette (*C*), pinch cock (*O*), capillary tip (*T*), filter paper (*P*), and vessel for catching filtered water beneath.

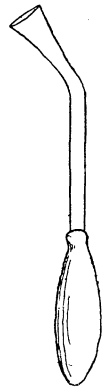

FIG. 2. Pipette with flattened tip for scraping filter paper, to remove filtered organisms.

copper wire rod, holding in its lower end a bit of cotton. This serves to stir up the material which it is desired shall be deposited upon the filter paper, to prevent it from settling and adhering to the sides of the glass, on the slopes of the taper.

When the entire amount of water has passed through the filter-paper, the latter is removed, spread out, and immersed in a bath of water, in a watch crystal. The water should just cover the filter-paper.

The device shown in Fig. 2 is now brought into play. This consists of a glass pipette, flattened and spread at its tip, and serves admirably for gently scraping and sucking the surface of the filter-paper, as it lies in the watch crystal. This withdraws into the pipette the organisms which have been filtered out. These can now be transferred to a glass slip and examined under the microscope, or injected into culture media as inoculations.

The writer has found that, with practice, the possibilities of the micro-filter may be extended to aid, in many ways, in the study of the protozoa.

LEON A. HAUSMAN

CORNELL UNIVERSITY

COMPLETE LINKAGE IN *DROSOPHILA MELANOGASTER*[1]

IN 1917 a mating appeared in the cultures of the authors, the flies from which showed no crossing over in the region scute to forked of the sex chromosome, although the factors echinus, cut, vermilion and garnet, were between the extreme points. This culture appeared spontaneously; selection played no part in it. The stock from this culture has now passed through not less than 80 generations and numbers over 3,000 matings. During this time no crossing over has appeared within the known length of the sex chromosome.

In experiments including the second chromosome points, black and purple, it has been shown that no crossing over takes place between these points when complete linkage exists for the first chromosome. Likewise the third chromosome points, dicheate and hairless, have shown complete linkage when the points scute to forked in the first chromosome, and the points black to purple in the second chromosome show the same phenomena.

The disturbing cause is genetic, behaving as a recessive. Its

[1] Papers from the Biological Laboratory, Maine Agricultural Experiment Station, No. 142.